ADDENDA TO IB-31622

(TR-22 TELEVISION TAPE RECORDER SERVO SYSTEMS MAINTENANCE)

The purpose of this addenda is to revise IB-31622 to include circuit modifications and other changes which have been incorporated into the headwheel servo, capstan servo, and power amplifier circuits of TR-22 Television Tape Recorders bearing serial numbers to 1301. (No alterations are required in the guide servo area of the instruction book.) The addenda has been divided into three separate sections, each section preceded by the serial numbers of the machines to which the changes apply.

Modifications in the capstan servo system are due primarily to integration of the two-speed feature in later model machines. These modifications are also applicable in general to earlier model machines which have had the Two-Speed Conversion kit (MI-40651) installed.

Figures in this addenda to be substituted for figures in instruction book IB-31622 are identified similarly to those in the instruction book, but with the letter "a" following the figure number. These figures will be found at the rear of the addenda.

HEADWHEEL SERVO
(SERIAL NOS. 1101 THROUGH 1300)

PAGE 7. In figure 3, change the designation of transistor Q17 from SWITCHER to EMITTER FOLLOWER/DELAY GENERATOR.

PAGE 8. In figure 4, change the pin number to which one side of the coil of relay K1 is connected from P1-11 to P1-6.

PAGE 9. In figure 5, change transistor Q7 type from 2N585 to 2N1306.

PAGE 11. In figure 6, make the following additions:

(1) Add resistor R29 (43K) between −18 volts and the base of transistor Q11.

(2) Add resistor R82 (1.5K) in the lead which connects the common collectors of transistors Q11 and Q12 to the junction of resistor R37 and capacitor C9 in the vertical multivibrator circuit.

PAGE 13. In the left-hand column, first paragraph, first sentence, delete . . . switching . . . and insert . . . emitter follower/delay generator . . .

PAGE 14. In figure 8, change the designation of transistor Q17 from SWITCHER to EMITTER FOLLOWER/DELAY GENERATOR.

PAGE 17. In figure 9, change the designation of transistor Q17 from SWITCHER to EMITTER FOLLOWER/DELAY GENERATOR.

PAGE 18. In figure 10, change resistor R9 (2.4K) in the collector circuit of transistor Q5 to resistor R16, 470 ohms.

PAGE 19. In figure 11, add resistor R29 (43K) from −18V to the base of transistor Q11.

PAGE 20. Delete figure 12 and substitute figure 12a of this addenda.

IB-31622-A

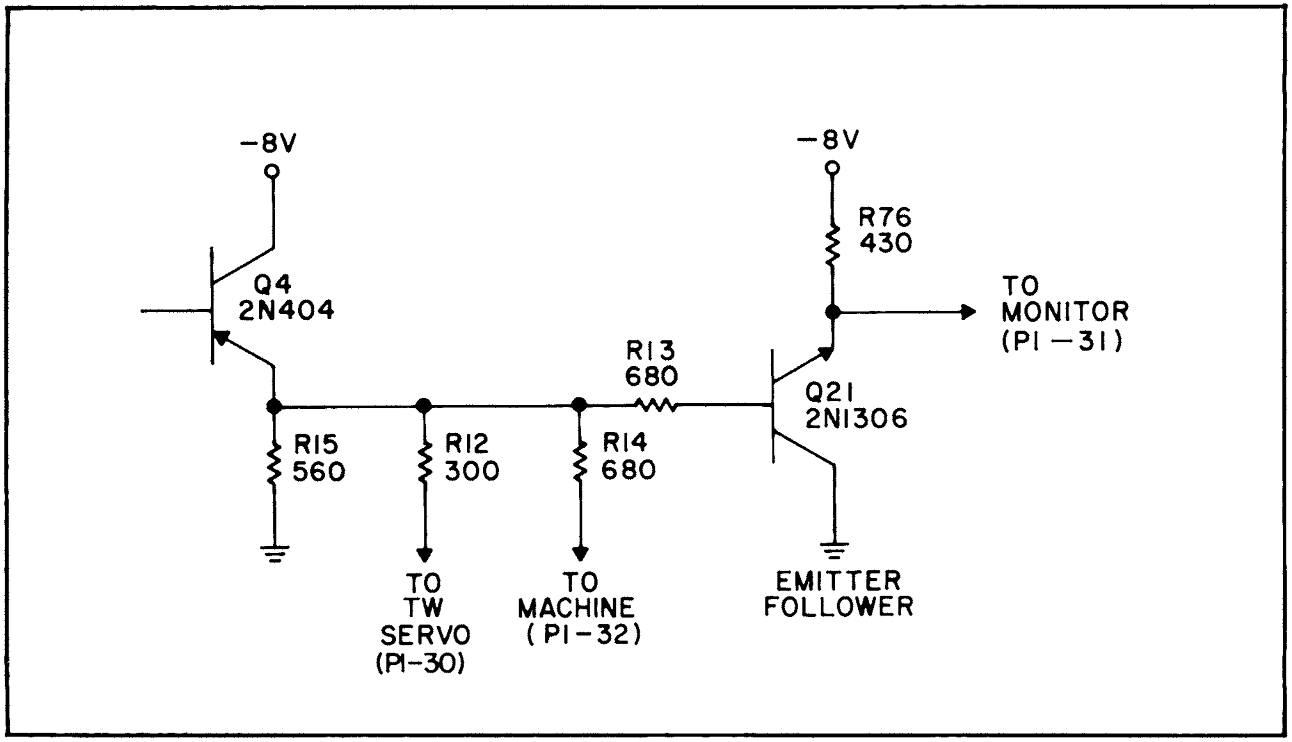


Figure 1—Modification to Figure 15 of IB-31622

PAGE 21. In figure 13, change the contact numbers of the section of rotary switch having its center arm grounded from 1, 2, 3, 4 to 7, 8, 9, 10 respectively.

PAGE 22. In figure 14, add emitter follower transistor Q21 in series with the tonewheel output signal to the monitor.

PAGE 23. Revise figure 15 to include the additional circuitry shown in figure 1 of this addenda.

PAGE 27. In figure 18, make the following changes:

(1) Resistor R66 from 68K to 33K.

(2) Capacitor C20 from 2400 to 6200.

(3) Transistor Q17 from type 2N404 to type 2N1307.

(4) Transistor Q18 from type 2N585 to type 2N1306.

PAGE 30. In figure 20, change the designation of transistor Q1 from SWITCH to EMITTER FOLLOWER/INVERTER.

PAGE 32. In figure 21, change the designation of transistor Q1 from SWITCH to EMITTER FOLLOWER/INVERTER.

PAGE 46. In figure 32, make the following transistor type changes:

(1) Q12, Q15, and Q18 from type 2N585 to type 2N1306.

(2) Q13, Q16, and Q19 from type 2N404 to type 2N1307.

PAGE 47. In figure 33, add capacitor C7 (100 μf) between ground (positive capacitor terminal) and the junction of resistors R16 and R27.

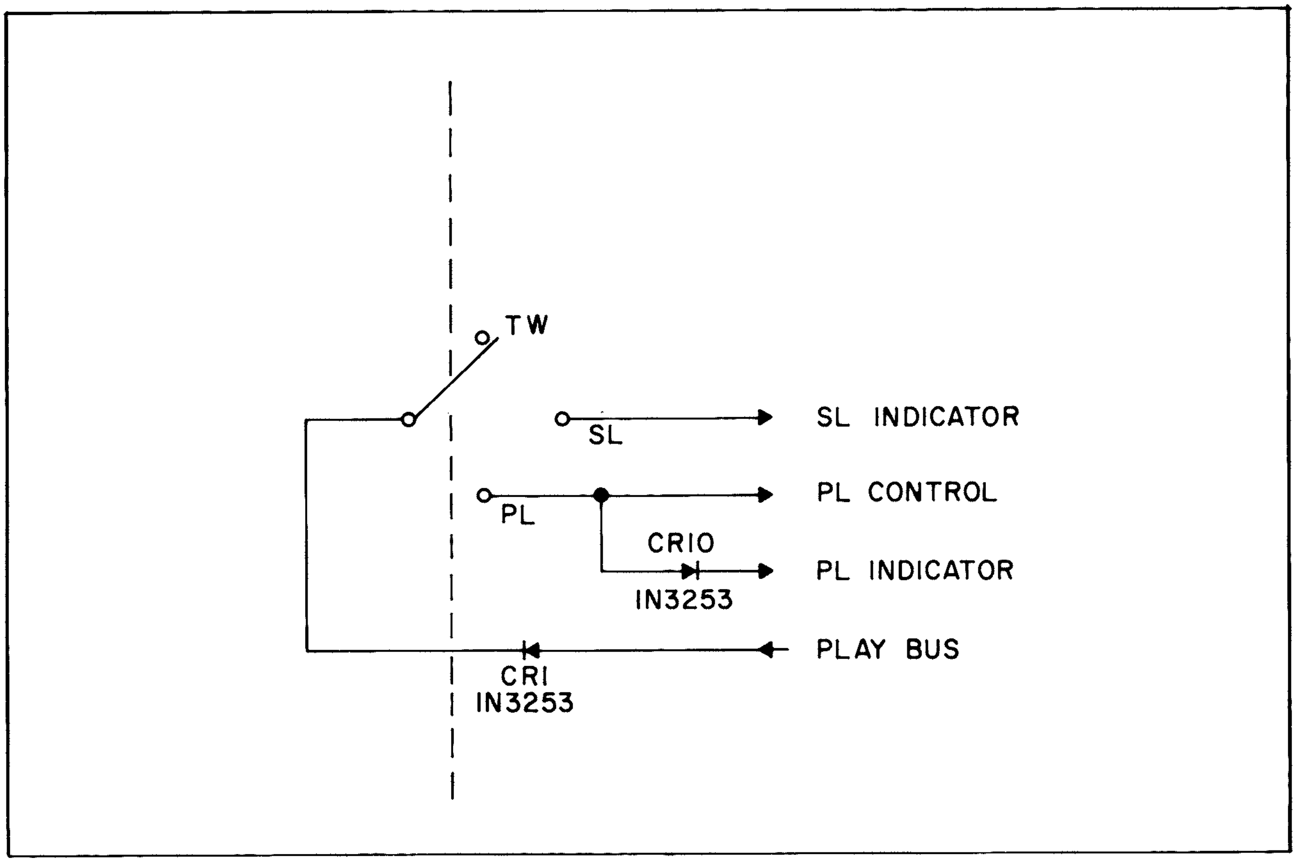


Figure 2—Modification to Figure 45 of IB-31622

PAGE 54. In figure 39, change the value of resistor R71 from 750 to 1300 ohms, and change the value of resistor R73 from 6800 to 9100 ohms.

PAGE 64. Revise figure 45 to include the additional circuitry shown in figure 2 of this addenda.

PAGE 66. In the left-hand column, replace the last paragraph with the following paragraph:

Because the signal at the collector of transistor Q4 is fed into a relatively high capacity load, the d-c potential at its collector would not normally fall rapidly to −8 volts when Q4 is driven into cut-off (at the end of the timed period). This condition is undesirable because any spurious signal occurring while the collector potential of transistor Q4 is falling toward −8 volts will act as a false multivibrator triggering pulse. To eliminate accidental triggering, especially during the vertical sync interval, the multivibrator duty cycle must be made very high (approximately 80%). However, in order to obtain a high duty cycle the time required for the collector potential to fall to −8 volts must be shortened considerably. This is accomplished by the multivibrator clamp circuit consisting of transistor Q25 and associated circuit components. When transistor Q3 is driven into conduction, the positive-going edge of the voltage transition at its collector drives transistor Q25 into conduction. This action effectively places resistor R11 in parallel with resistor R14, and the resulting time constant (R11-R14 in conjunction with the load capacitance) is shortened by a ratio of approximately 10 to 1. Thus the potential at the collector of transistor Q4 will fall to −8 volts very rapidly and the required high multivibrator duty cycle may be readily attained. Since the multivibrator duty cycle is approximately 80%, the multivibrator may be re-triggered only during the final 20% of a TV line and the desired immunity to false triggering due to noise and other spurious pulses is insured.

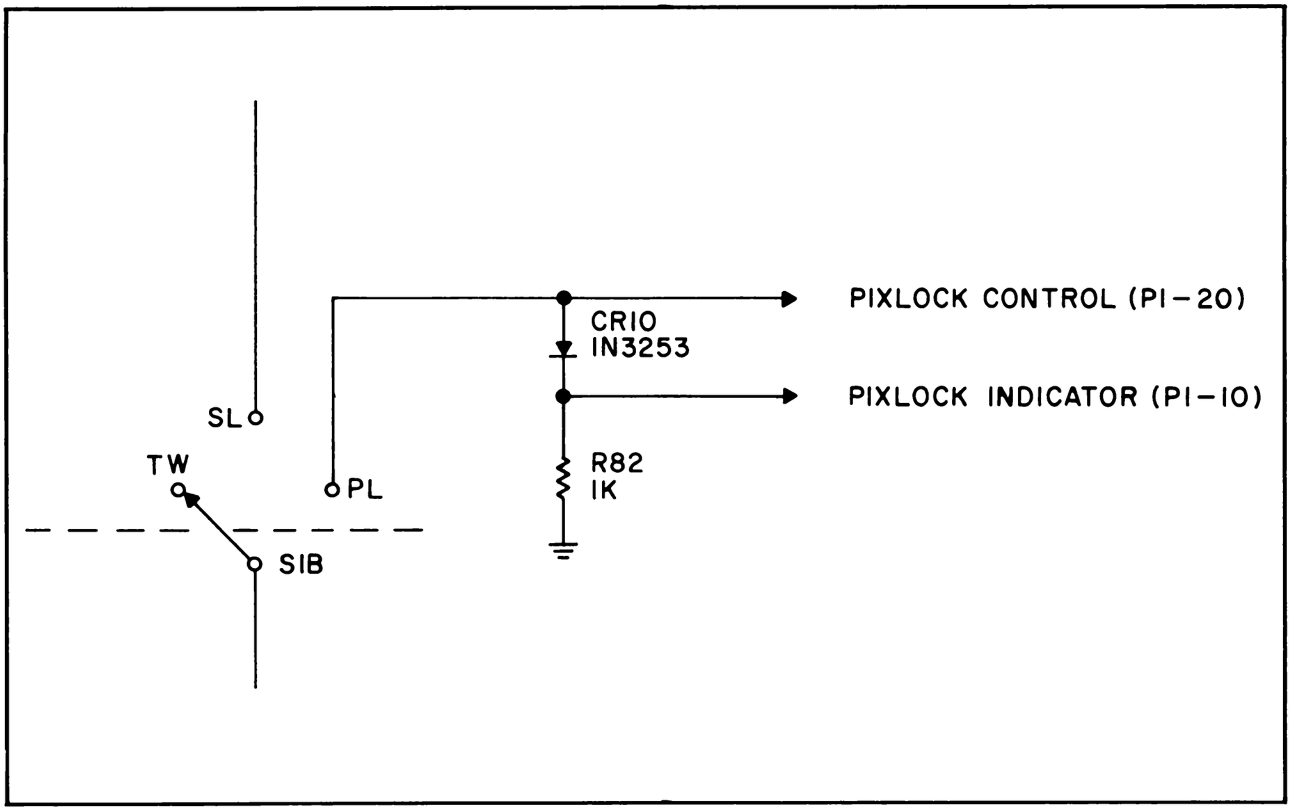


Figure 3—Modification to Figure 56 of IB-31622

PAGE 77. Revise figure 56 to include the additional circuitry shown in figure 3 of this addenda.

PAGE 78. In figure 57, make the same additions as are noted above for figure 45 on page 64.

PAGE 81. Delete figure 60 and substitute figure 60a of this addenda.

PAGE 151. Delete figure 124 and substitute figure 124a of this addenda.

PAGE 153. Delete figure 125 and substitute figure 125a of this addenda.

CAPSTAN SERVO SYSTEM (SERIAL NOS. 1201 THROUGH ~~1300)~~

PAGE 84. In the left-hand column, delete the first paragraph and replace with the following paragraph:

The purpose of the capstan servo system is to control the speed of the capstan motor and thus the speed at which tape runs through the machine. In addition to the normal tape speed of 15 inches-per-second (15.625 ips in International machines), the tape may be pulled through the machine at half-speed ($7\frac{1}{2}$ ips). The primary advantage of running the tape at half-speed is that at this speed twice as much recording time will be obtained from a given length of tape as would be obtained from the same length of tape running at a 15 ips rate. The increase in recording time in turn results in such advantages as reduction of tape costs, saving on tape storage space, and reduction in tape distribution expense. Although the tape speed is nominally 15 or $7\frac{1}{2}$ ips, during tape playback it is necessary that the capstan motor speed be tightly controlled by the capstan servo system to insure that exactly four video tracks are pulled past the rotating headwheel assembly during each rotation of the headwheel.

PAGE 84. In the left-hand column, second paragraph, change Capstan Power Amplifiers (nos. 330 and 331) to Capstan Power Amplifier (no. 331).

PAGE 84. In the right-hand column, first paragraph under RECORD mode heading, delete eighth line and replace with: the 60-cycle signal that drives the single-phase synchronous . . .

PAGE 84. In the right-hand column, first paragraph under RECORD mode heading, twelfth line, delete . . . signals . . . and replace with . . . signal . . .

PAGE 84. In the right-hand column, delete the last paragraph and replace with the following paragraph:

The binary counters produce a 60-cycle square wave signal which is converted into a sinusoidal signal and fed to a power amplifier. The power amplifier then provides the power required to drive the capstan motor. (See block diagram, figure 64a.)

PAGE 85. Delete figure 64 and substitute figure 64a of this addenda.

NOTE: Figures in this addenda to be substituted for figures in instruction book IB-31622 are identified similarly to those in the instruction book, but with the letter "a" following the figure number. Wherever reference is made in the instruction book to a figure which has been substituted in this addenda, the substitute figure should be referred to.

PAGE 85. In the right-hand column, last paragraph, delete the last sentence and replace with the following sentence:

In addition to these presentations on the CRO monitor, provision is made for observation of the motor drive signal as a means of checking the normal output which drives the capstan power amplifier during the recording process.

PAGE 86. Delete figure 65 and substitute figure 65a of this addenda.

PAGE 86. In the left-hand column, first paragraph, delete the last sentence and insert the following sentence:

The 240-cycle output signal from the oscillator is divided-down by the binary counters and formed into the 60-cycle capstan motor drive signal, in exactly the same manner as is the tonewheel pulse during recording.

PAGE 87. Delete figure 66 and substitute figure 66a of this addenda.

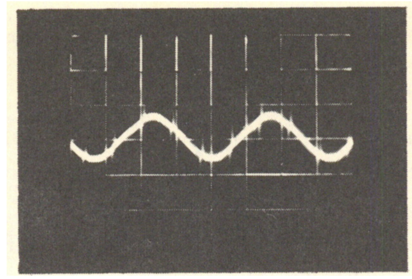
PAGE 88. Delete Capstan Oscillator (no. 322) ϕ_1 *and* ϕ_2 *Gain* adjustment procedure and replace with the following procedure:

Output Level

1. Place machine in SETUP mode.

2. Press CM pushbutton (located above the guide servo module, no. 221), and vary LEVEL adjustment on the capstan oscillator module front panel to obtain a reading of 100 volts on the multimeter (located directly below the picture monitor).

PAGE 116. In figure 94, change the value of resistor R40 from 16K to 20K.



P1-29 (RECORD mode), Motor Drive Matrix, 0.2v/cm. (5 msec/cm)

Figure 4—B in Figure 95 of IB-31622

PAGE 118. Delete B of figure 95 and substitute waveform shown in figure 4 of this addenda.

PAGE 119. Delete figure 96 and substitute figure 96a of this addenda.

PAGE 119. In the left-hand column, delete the first two sentences in the first paragraph and replace with the following sentences:

The capstan oscillator module (no. 322) converts a 240-cycle signal into a 60-cycle sine wave output. The sinusoidal output is fed to the capstan power amplifier module (no. 331), which in turn furnishes the power required to drive the two-speed capstan motor. (In International machines, the input signal occurs at a 250-cycle rate and is converted into a 62.5-cycle sinusoidal output.)

PAGE 119. In the left-hand column, delete the second paragraph and replace with the following paragraph:

In either mode of machine operation, the 240-cycle signal is divided-down by two cascaded binary counters. (See block diagram, figure 96a.) The output from the second binary counter is a 60-cycle square wave which is converted into a 60-cycle sine wave by filter circuits. The sinusoidal signal is then amplified to approximately 6 volts peak-to-peak and fed to the capstan power amplifier module.

PAGE 119. In the right-hand column, delete the first paragraph.

PAGE 120. Add the following to figure 97: Insert capacitor C22 (.0033) between the emitter of transistor Q11 and a line terminated with an arrow-head. Designate the arrow-head: TO MOTOR DRIVE MATRIX (P1-30).

PAGE 121. In the left-hand column, second paragraph, fourth line from bottom, delete . . . phase . . . and insert . . . output . . .

PAGES 122 through 125. Delete *Binary Counter Circuits* description and replace with the circuit description below. Also, delete figures 98, 99, and 100, and replace with figures 98a and 99a of this addenda.

Binary Counter Circuits

The binary counter circuits (figure 98a) divide-down the frequency of the output signal from either the 240/250-cycle oscillator or the tonewheel amplifier (depending upon the tape recorder mode of operation) and furnish a 60/62.5-cycle square wave signal to the filter and output amplifier circuits.

The first ÷2 binary counter (figure 98a), consisting of transistors Q12, Q13 and associated circuit components, is a bistable device in which the transistors are d-c coupled. Therefore, either transistor will continue to conduct, while the opposite transistor remains cut off, until the state is reversed by a positive-going triggering pulse which cuts off the conducting transistor. In the PLAY mode of tape recorder operation, the 240-cycle square wave output from the collector of transistor Q1 in the oscillator circuit is differentiated by the networks consisting of capacitor C15, resistor R61 and capacitor C16, resistor R62. The positive-going spikes resulting from the differentiation are fed simultaneously through diodes CR15 and CR16 to the bases of transistors Q12 and Q13 respectively.

Assuming transistor Q12 to be saturated and transistor Q13 to be cut off, the positive-going spike will have no effect on Q13 but will cut Q12 off. The collector potential of transistor Q12 then immediately falls to approximately −18 volts, and this potential is d-c coupled to the base of transistor Q13, thus driving the transistor into saturation. The transistors will remain in this state until the next positive-going spike occurs (corresponding to the positive-going edge of the 240-cycle square wave) and cuts off transistor Q13. The output at the collector of transistor Q13 will then be a 120-cycle square wave signal as shown on the timing diagram (figure 99a). "Speed-up" capacitors C20 and C30 (3300 $\mu\mu$fd) assure more positive transistor switching so that the output square wave signal will have sharply defined timing edges. A of figure 98a shows the divide-by-two action of the multivibrator.

When the machine is operated in the RECORD mode, the 240-cycle tonewheel pulse applied to the module via pin 20 of plug P1 is amplified by transistor Q11 and fed to the first ÷2 binary counter circuit. The amplified pulse is differentiated in the same manner as is the 240-cycle square wave fed to the counter circuit from the oscillator during tape playback, and the counter then operates exactly as described above.

The 120-cycle square wave signal at the collector of transistor Q13 is fed to the second ÷2 binary counter circuit consisting of transistors Q3, Q4 and associated circuit components. The second binary counter, also a bistable device, operates similarly to the first ÷2 binary counter with the exception that in the second binary counter circuit the non-conducting transistor is driven into saturation by the negative-going spike resulting from the differentiation of the 120-cycle square wave. Once again a divide-by-two action is attained, and the output signal at the collector of transistor Q4 is a 60-cycle square wave as shown in B of figure 98a. This signal is then fed to a filter network which converts it into a 60-cycle sine wave.

PAGES 125 through 127. Delete *60-Cycle Filter and Phase Amplifier Circuits* description and replace with the circuit description below. Also, delete figure 101 and replace it with figure 101a of this addenda.

60-Cycle Filter and Output Amplifier Circuits

The 60-cycle square wave output at the collector of transistor Q4 in the second binary counter circuit is fed into a three-section low-pass filter network which converts the square wave into a relatively pure 60-cycle sine wave (figure 101a). The filter sections, consisting of resistors R32, R34, R36, and capacitors C9, C10, C11 are coupled by emitter follower transistors Q5, Q6, and Q7 to obtain impedance scaling. The emitter follower transistors provide an isolation ratio of approximately 25:1 between each resistance-capacitance section, thereby reducing the loading effect which each section presents to the preceding one. (A, B, and C of figure 101a show the development of the 60-cycle sine wave.)

Transistor Q8, operating as a common emitter amplifier, amplifies the sinusoidal output from the filter circuit. The gain of the amplifier is determined by the resistance ratio of resistor R41 and a portion of potentiometer R40 (depending upon the setting of the potentiometer) to resistor R42. Therefore, the amplitude of the 60-cycle sinusoidal output at the collector of transistor Q8 is determined by the setting of potentiometer R40 (LEVEL). The potentiometer is normally adjusted to obtain an output signal of approximately 6 volts peak-to-peak

(see *Adjustments*). This signal may be observed at test point TP1 (OUT), and is shown in D of figure 101a.

When the machine is in the STOP mode, the RUN bus potential is −26 volts and diode CR19 is cut off. This places a negative bias voltage on the base of gating transistor Q9 from the voltage divider network consisting of resistors R45, R46, and R94, and the transistor is saturated. The output signal from output amplifier transistor Q8 is then bypassed through transistor Q9 to ground. Therefore, when the machine is in the STOP mode, there will be no output voltage to the capstan power amplifier and the capstan motor will not run. When the machine is in an operating mode (i.e., any mode except STOP), the RUN bus is at ground potential. This cuts off diode CR19 and causes the potential on the base of gating transistor Q9 to shift to a positive value which cuts Q9 off, thus allowing the motor drive signal to pass. The 60-cycle sinusoidal motor drive signal is then fed via pin 32 of plug P1 to the capstan power amplifier module (no. 331).

In addition to being fed to the capstan power amplifier module, in the RECORD mode the motor drive output signal is combined with the 240-cycle pips which result from the differentiation of the pulse appearing at the emitter of tonewheel amplifier transistor Q11. Differentiation is accomplished by resistor R56 and capacitor C22 in the emitter circuit of transistor Q11. During machine operation in the RECORD mode then, the combined waveform is fed via pin 30 of plug P1 to the CRO driver circuit in the capstan error module (no. 321) and may be observed on the CRO monitor when the CAP SERVO pushbutton on the CRO monitor switcher is depressed.

When the machine is operating normally, in the RECORD mode, the phase relationships between the 60-cycle motor drive signal and the 240-cycle pips will be as shown in E of figure 101a. (This waveform will be identical for the 62.5-cycle sine wave and 250-cycle pips obtained in International machines.) A positive check of headwheel to capstan motor "lock" during recording may be made by observing the combined waveform on the CRO monitor, with the CAP SERVO pushbutton on the CRO monitor switcher depressed, and noting the absence of relative drift between the 60-cycle motor drive signal and the 240-cycle pips.

PAGE 127. Delete the *ϕ_1 and ϕ_2 Gain* adjustment procedure and replace with the following adjustment procedure:

LEVEL

1. Place the machine in SETUP mode.

2. Press the CM pushbutton (above the guide servo module) and note the voltage reading on the multimeter (below the picture monitor).

3. Vary the LEVEL screwdriver adjustment on the capstan oscillator module front panel to obtain a reading of 100 volts on the multimeter.

PAGE 155. Delete figure 126 and substitute figure 126a of this addenda.

POWER AMPLIFIERS (SERIAL NOS. 1001 THROUGH ~~1300~~)

PAGE 144. Revise figure 117 to include the current source transistors Q12 and Q13 as shown in figure 5 of this addenda.

PAGE 144. In the left-hand column, delete the first paragraph and replace with the following paragraph:

Five power amplifier modules (nos. 330 through 334) are supplied with the TR-22 Television Tape Recorder. Three of the power amplifiers (nos. 332, 333, and 334) provide the power gain necessary to drive the three-phase synchronous headwheel motor. The input voltages to the

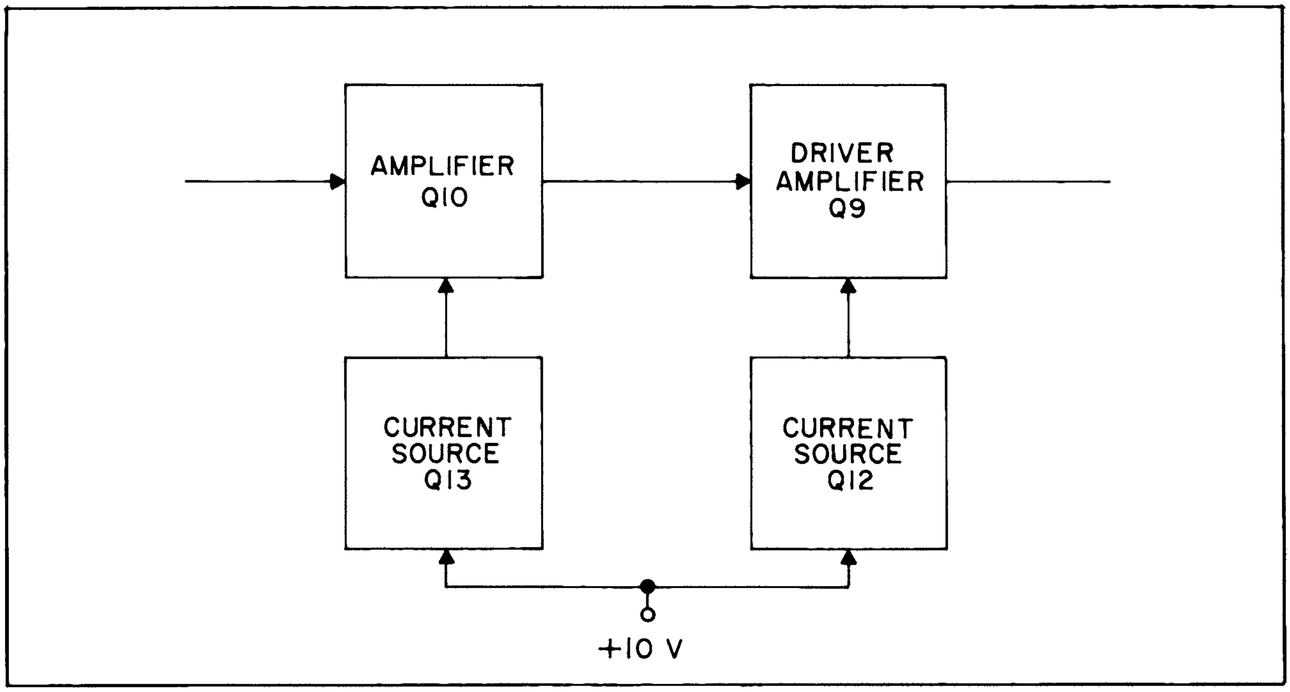


Figure 5—Modification to Figure 117 of IB-31622

headwheel power amplifiers are 480-cycle voltages, differing in phase by 120 degrees, and are obtained from the headwheel modulator module (no. 315). The two remaining power amplifier modules (nos. 330 and 331) are used to drive the two-phase synchronous capstan motor in machines which are equipped with the single-speed capstan motor. The input voltages to these modules are 60-cycle voltages, differing in phase by 90 degrees. In machines having the two-speed, single-phase capstan motor, either as standard equipment or as an installed accessory, only one power amplifier module is required. This module is no. 331, and module no. 330 then becomes a spare. The input voltage to the capstan power amplifier, or amplifiers, is obtained from the capstan oscillator module (no. 322). Since the circuitry of each of the five power amplifier modules is identical, the modules are interchangeable.

PAGE 144. In the left-hand column, insert the following NOTE after the second paragraph:

> NOTE: Since power amplifier module no. 330 is not used in machines equipped with the two-speed motor, pins 8 and 24, and 10 and 26 of its receptacle are soldered together. This permits the machine to operate normally with module no. 330 removed.

PAGE 145. In figure 118, add a lead terminated with an arrowhead to the junction of resistor R1 and fuse F1. Insert the designation TO EMITTER FOLLOWER Q3 opposite the arrowhead. Also, add 3 AMP, 8AG to fuse F1.

PAGE 145. In the left-hand column, delete the first paragraph and replace with the following paragraph:

The sinusoidal input voltage fed to the power amplifier module through pin 19 (jumpered to pin 9) of plug P1, occurring at a 60-cycle rate in the capstan servo system and at a 480-cycle rate in the headwheel servo system, is coupled by capacitor C2 to the base of transistor Q3 (figure 119a). Transistor Q3 functions as an emitter follower, and its purpose is to isolate the input from the succeeding amplification circuits while at the same time maintaining a relatively constant input impedance. The negative bias potential applied to the base of transistor Q3 from the voltage divider network consisting of resistors R10 and R11 is nominally −5.6 volts

and, since the emitter of Q3 is returned to ground through resistor R12, the transistor is biased into conduction. Transistor Q3 will then pass the normal a-c signal fed to its base. However, when the input signal amplitude becomes excessive, as it may when the headwheel motor is starting up, the transistor is driven alternately into saturation and cut-off and thus a protective limiting action occurs. Resistors R16 and R12 determine the actual amplitude of the signal appearing at the emitter of transistor Q3.

PAGE 145. In the left-hand column, second paragraph, delete the first sentence and substitute the following sentences:

The signal at the emitter of transistor Q3 is coupled via capacitor C3 to the base of amplifier transistor Q5. The bias potential at the base of transistor Q5 is fixed at approximately −6.5 volts by the divider network consisting of resistors R14 and R13, and the transistor is normally driven into conduction due to the fact that the potential at its emitter is negative with respect to that at its base.

PAGE 146. Delete figure 119 and substitute figure 119a of this addenda.

PAGE 146. In the right-hand column, add the following sentence at the end of the first complete paragraph:

Gain stabilization is further aided by providing transistors Q4 and Q6 with a continuous current path directly from the +10 volt bus and by providing transistors Q10 and Q9 with a continuous current path from the +10 volt bus via the current source transistors Q13 and Q12 respectively.

PAGE 146. In the right-hand column, second paragraph, delete the last three sentences and substitute the following sentences:

In a capstan power amplifier module the output voltage is fed directly to pins 18 and 22 of plug P1. However, in a headwheel power amplifier module the output voltage is fed through resistors R29 and R33 in parallel to pins 17 and 6 of plug P1. Resistors R29 and R33 provide a resistance of 1 ohm at high wattage for isolation purposes; i.e., to eliminate cross-talk between the phases of the 3-phase motor drive sine wave.

PAGE 146. In the right-hand column, last paragraph, delete the first sentence and substitute the following sentence:

The 60-cycle output voltages from the capstan power amplifier modules in machines equipped with the single-speed capstan motor differ in phase by 90 degrees and have an amplitude of approximately 17 volts rms.

PAGE 147. For machines equipped with the single-speed capstan motor, change the caption of figure 120 to read as follows:

Figure 120—Capstan Power Amplifier and Single-Speed Motor Circuits

PAGE 147. For machines equipped with the two-speed capstan motor, delete figure 120 and substitute figure 120a of this addenda.

PAGE 149. In the left-hand column, six lines from the top of the page, insert the following sentences:

The 60-cycle output voltage from the capstan power amplifier module in machines equipped with the two-speed capstan motor is fed from pin 18 of plug P1 through the electrolytic capacitor 11C1 (located on the rear shelf) to transformer 11T1 (figure 120a). Capacitor 11C1 blocks the d-c component of the output voltage and has a high capacitance (5600 microfarads)

because of the low transformer and reflected motor impedance. Transformer 11T1 steps up the motor voltage to approximately 115 volts rms before it is fed to the two-speed capstan motor, and capacitor C1, part of the two-speed motor assembly, is the motor phase capacitor.

PAGE 149. In the left-hand column, third paragraph, eighth line, delete . . . either . . . and substitute . . . a . . .

PAGES 149 and 150. Delete steps 1 through 5 of the trouble-shooting procedure and substitute the following 13 step procedure:

1. Turn off the machine, remove the defective module, and check all transistors with an ohmmeter for collector-to-emitter short circuits.

> *CAUTION: When checking transistors for collector-to-emitter short circuits, use RX100 or RX1000 scale on the ohmmeter.*

2. Replace any transistors found to be shorted.

3. Remove the headwheel modulator (module no. 315), capstan oscillator (module no. 332), and remaining power amplifier modules.

4. Place the defective power amplifier module on a module extender and plug into the machine.

5. Disconnect the wires that are connected to pins 17 and 18 of the power amplifier plug to remove the amplifier load. (The power amplifiers may be safely operated under no load conditions.)

6. Remove the blown fuse and connect a 100 ohm, 50-watt, current limiting resistor in place of the fuse.

7. Connect the vacuum tube voltmeter or the oscilloscope to the negative (−) side of capacitor C5 and check the d-c voltage. If this voltage is approximately half that at the emitter of transistor Q1 the amplifier is balanced and is therefore operating normally.

8. If the d-c voltage measured in step 7 indicates that the amplifier is not properly balanced, one of the transistors is breaking down under the applied voltage. (This type of breakdown can only be detected with a transistor curve tracer or in an amplifier.) The primary transistors to check are Q6, Q4, Q7, Q10, Q9, and Q11. Replace each of these transistors, one at a time, until the faulty transistor is found.

9. When the faulty transistor has been replaced and the d-c voltage as measured in step 7 is correct, re-connect the wires to pins 17 and 18 of the power amplifier plug, remove the 100 ohm, 50-watt resistor, and insert a 1.5 ampere, 8AG, fuse into the fuse holder.

10. Turn the machine on. If the power amplifier fuse does not blow, turn the machine off and replace the 1.5 ampere fuse with a 3 ampere, 8AG, fuse.

11. Re-insert the headwheel modulator and capstan oscillator modules, and turn the machine on once again.

12. If the power amplifier fuse does not blow, turn the machine off, remove the power amplifier module from the module extender, and re-insert all power amplifier modules.

13. As a final check, turn the machine on in the STANDBY mode and observe that the motor (headwheel or capstan) is operating properly.

PAGE 150. In the left-hand column, change the number of step 6 to step 14.

PAGE 150. In the DC VOLTAGE TABLE, delete the column of test voltages and the note pertaining to the column. Also, change the Q3 BASE voltage to −5.6 volts, the Q3 EMITTER voltage to −5.4 volts, and the Q3 COLLECTOR voltage to −13 volts.

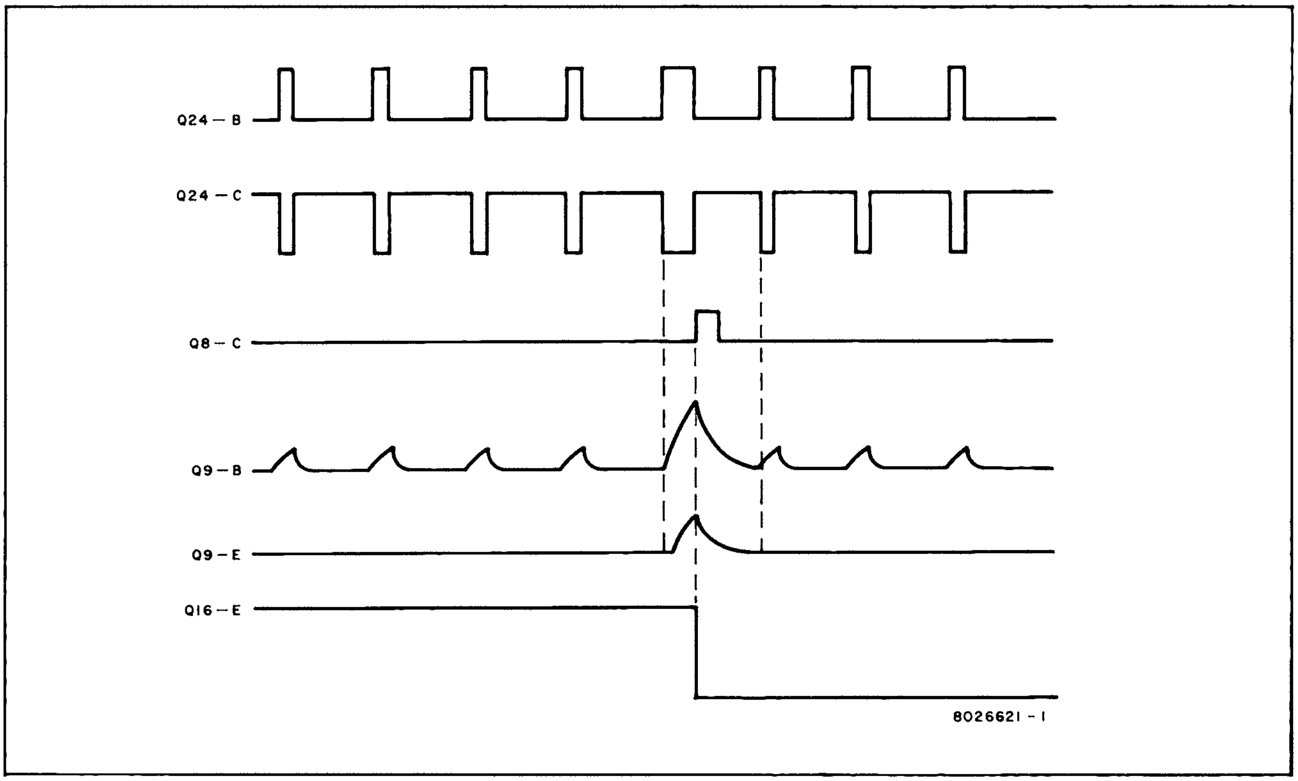


Figure 12a—Vertical Sync Separation in 819-Line French System

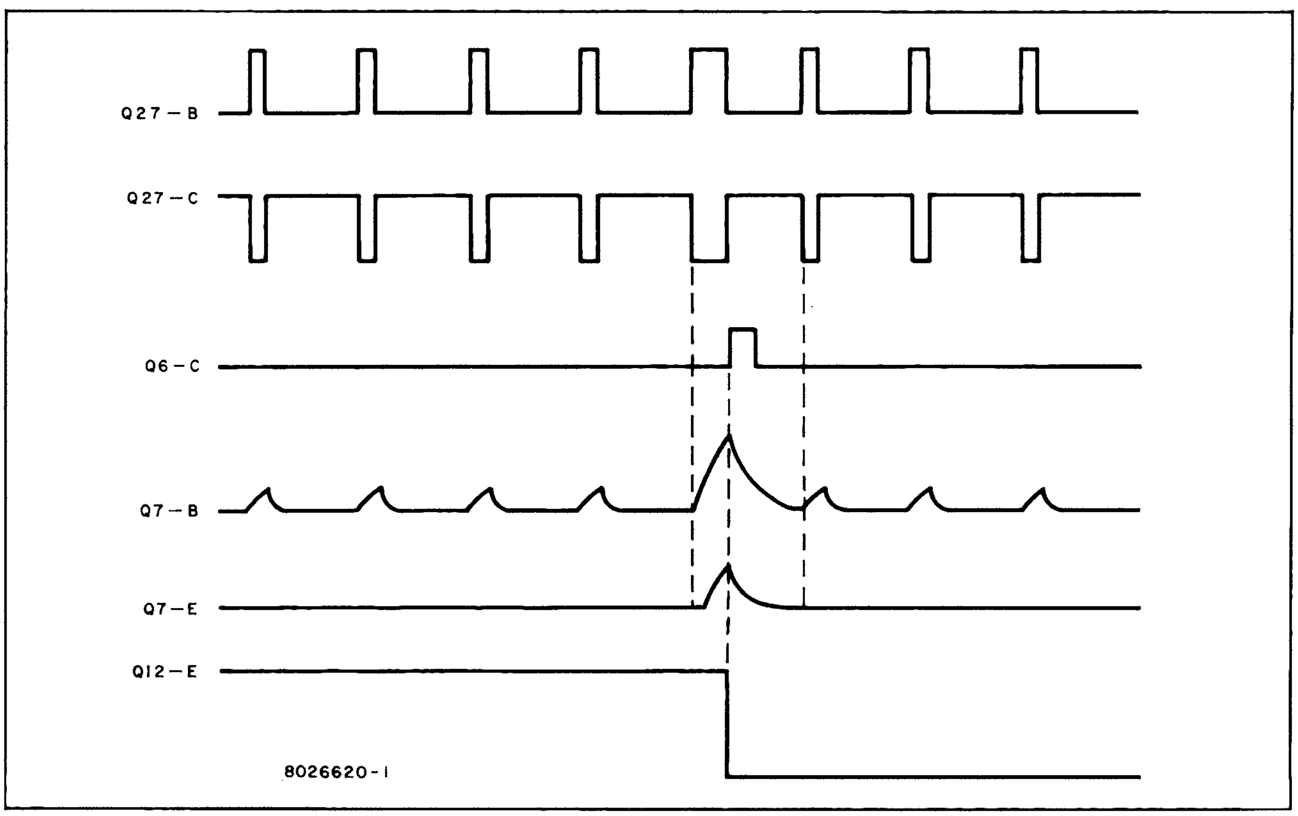


Figure 60a—Vertical Sync Separation in 819-Line French System

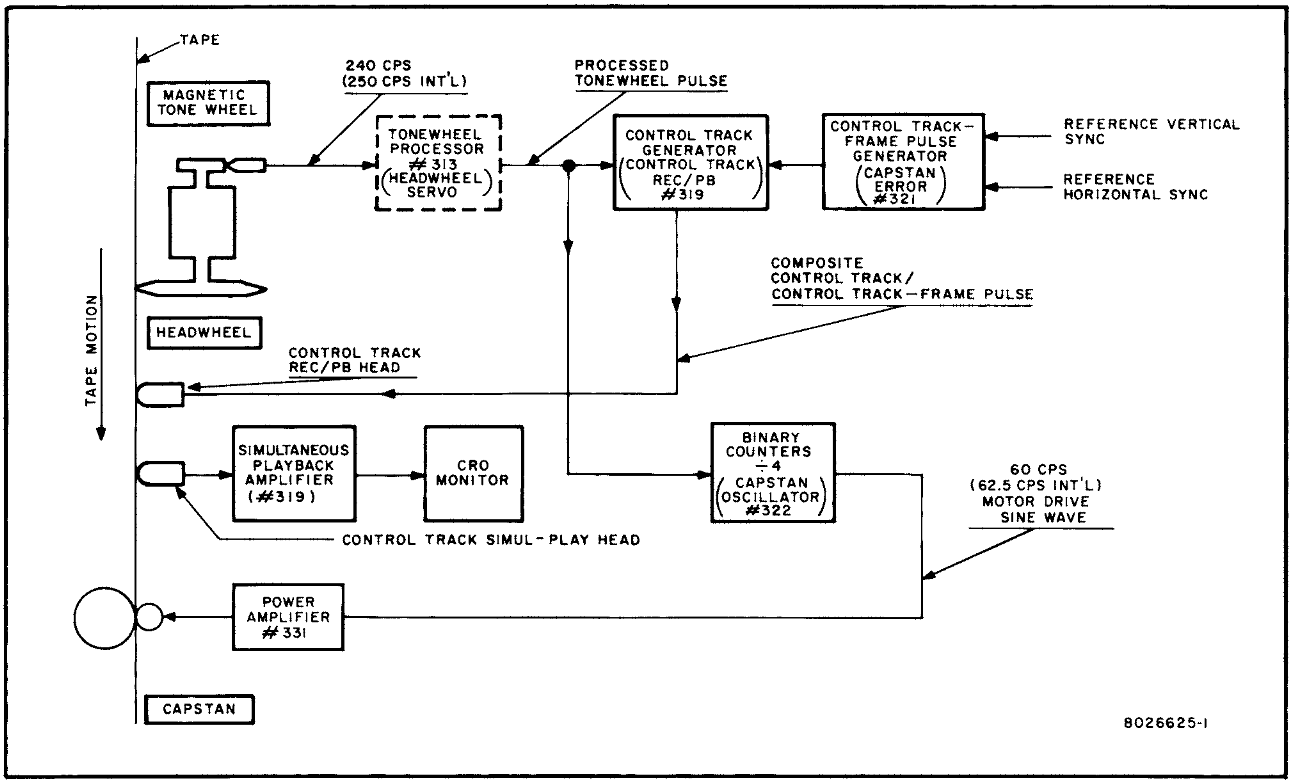


Figure 64a—Capstan Servo System (RECORD Mode)

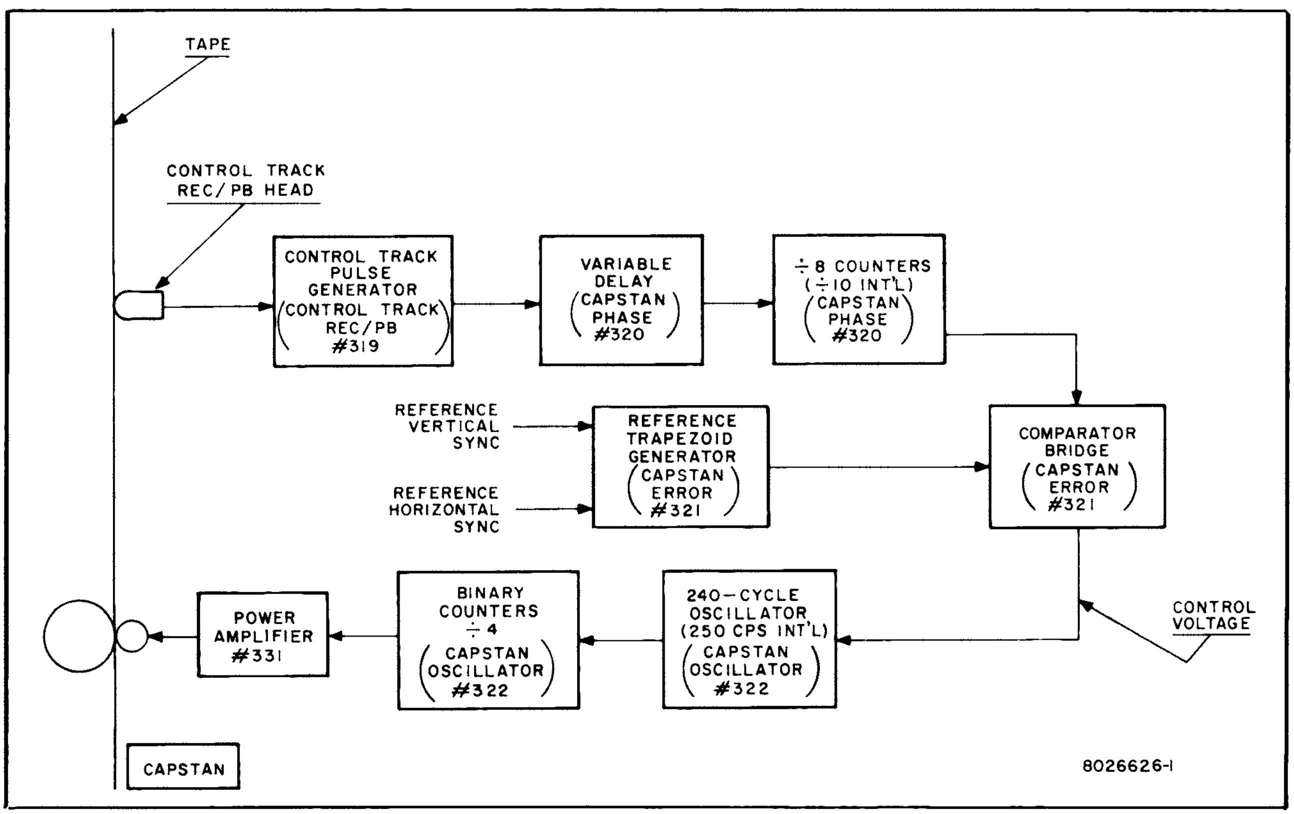


Figure 65a—Capstan Servo System (Playback in Tonewheel Mode)

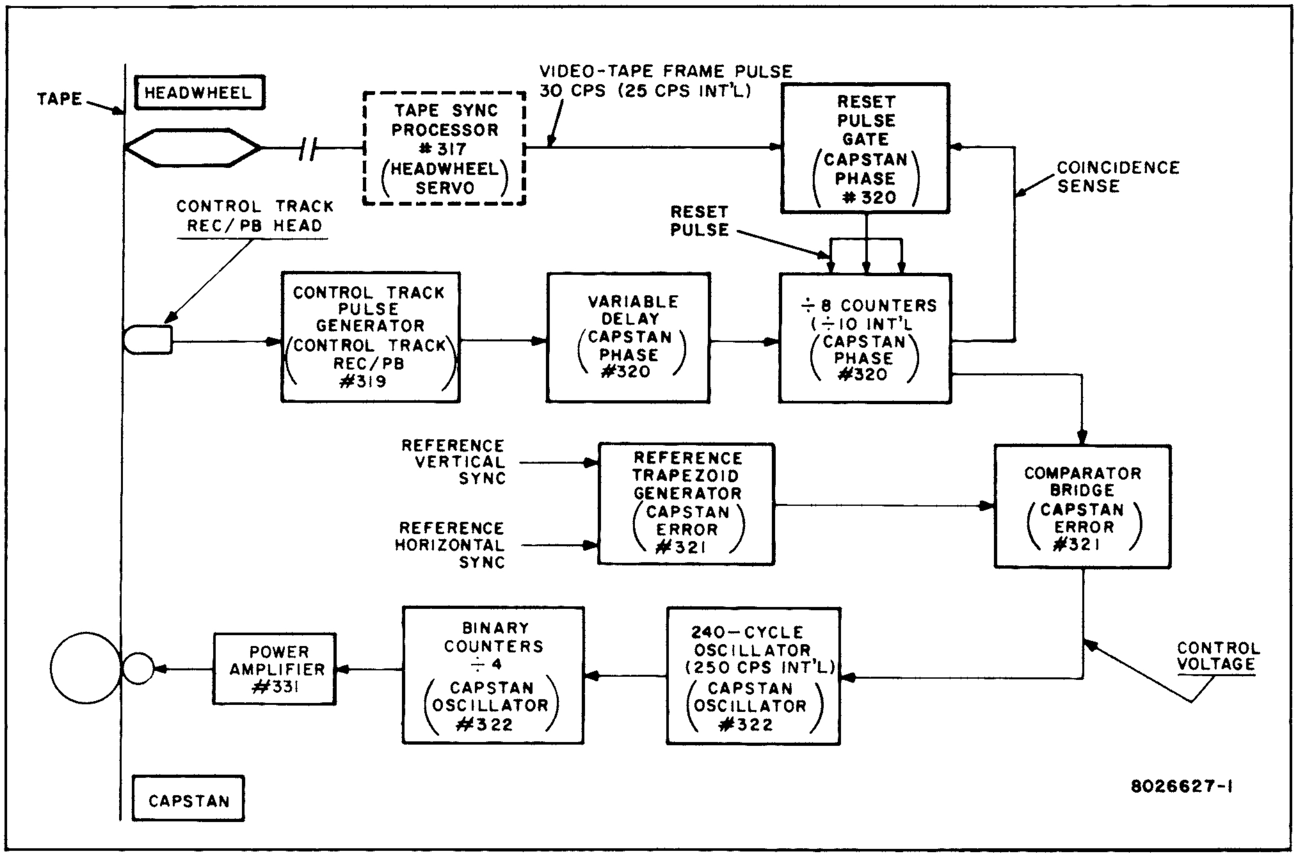


Figure 66a—Capstan Servo System (Playback in Switchlock or Pixlock Mode)

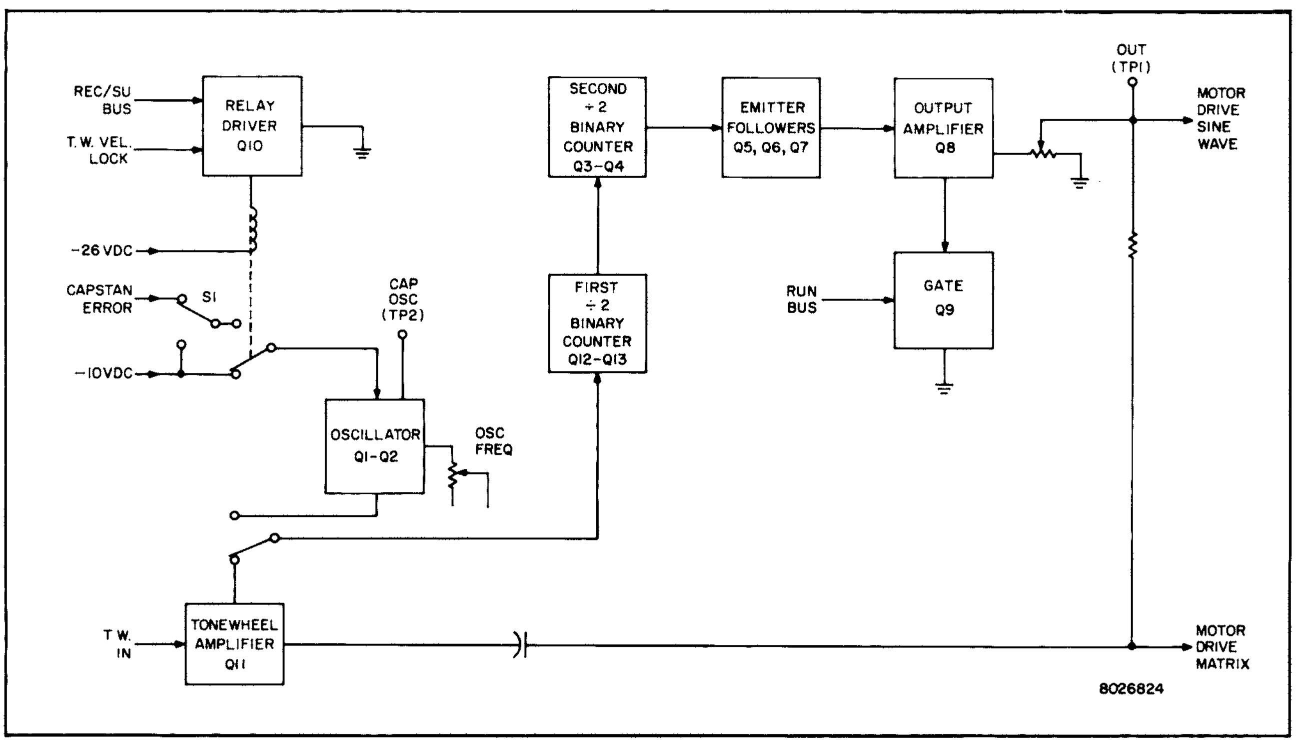
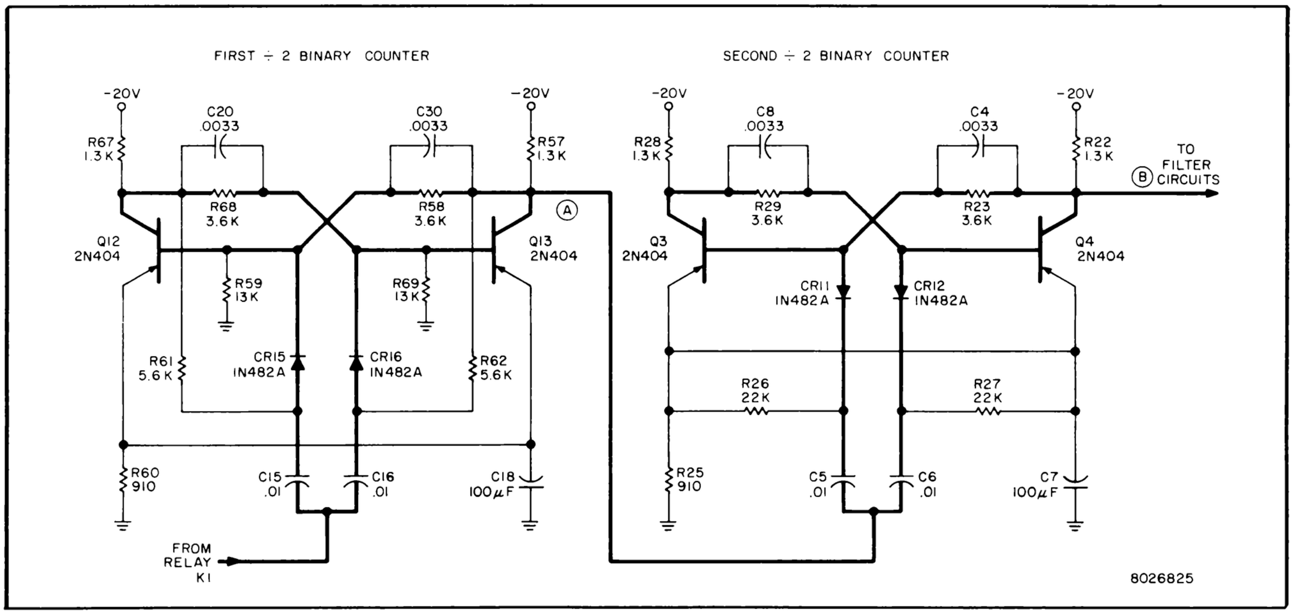


Figure 96a—Capstan Oscillator Module Block Diagram



A. Top: Q13 collector, 10v/cm.
Bottom: Q1 collector, 10v/cm.
(2 msec/cm)

B. Top: Q4 collector, 5v/cm.
Bottom: Q13 collector, 10v/cm.
(5 msec/cm)

Machine in PLAY mode.

Figure 98a—Binary Counters

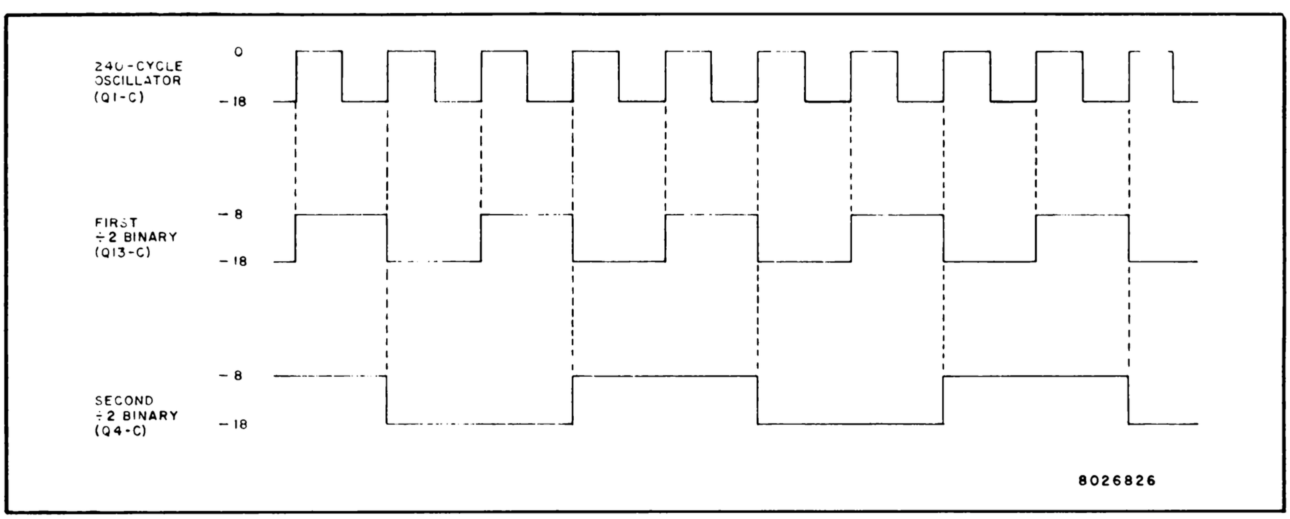
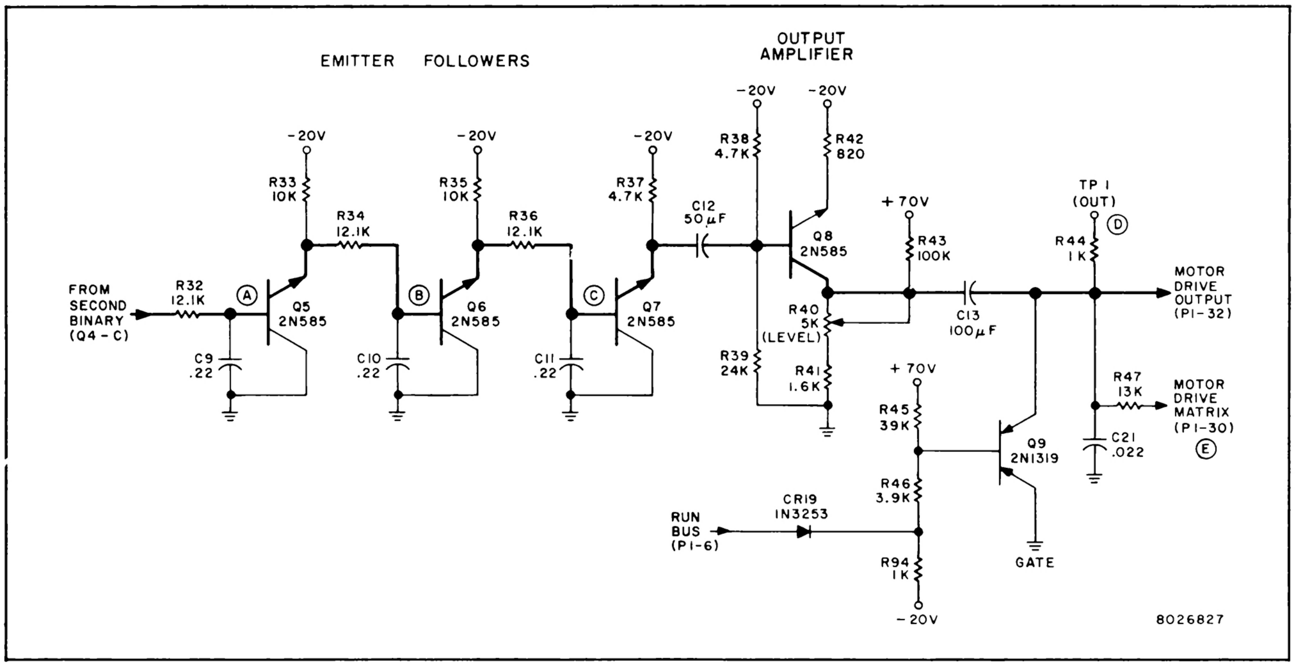
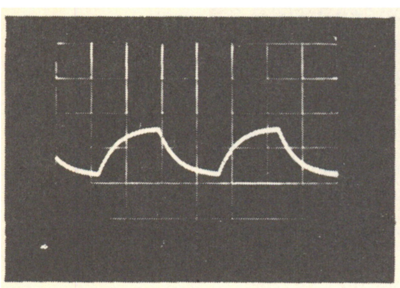
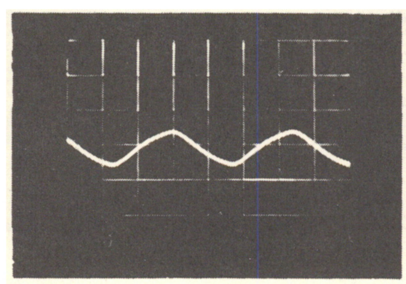


Figure 99a—Binary Counter Waveform Timing Relationships

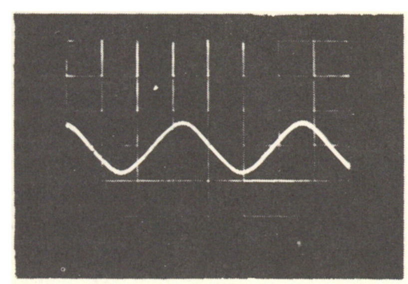




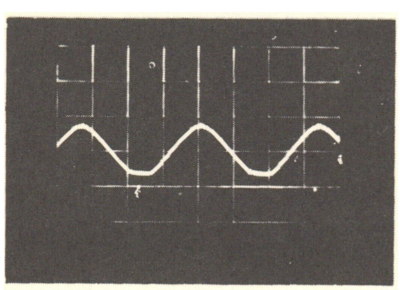
A. Q5 base.



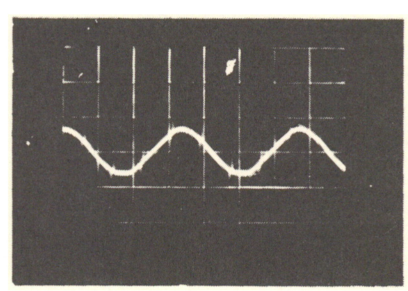
B. Q6 base.



C. Q7 base, 2v/cm.



D. TP1 (OUT)



E. P1-30 (Motor Drive Matrix), 2v/cm. (RECORD mode)

Machine in PLAY mode, sweep times 5 msec/cm, and amplitudes 5v/cm, unless otherwise noted.

Figure 101a—60-Cycle Filter and Output Amplifier Circuits

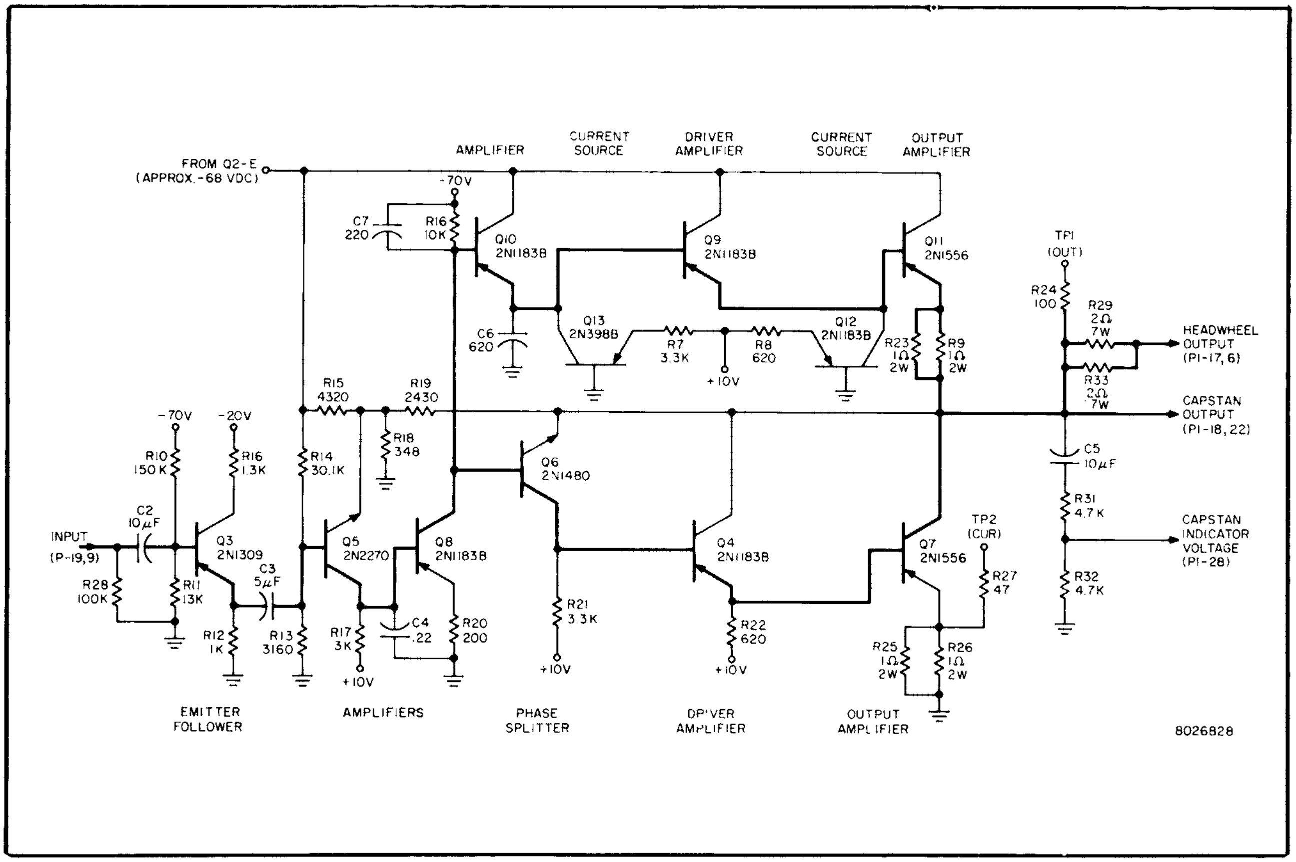


Figure 119a—Amplifier Circuits

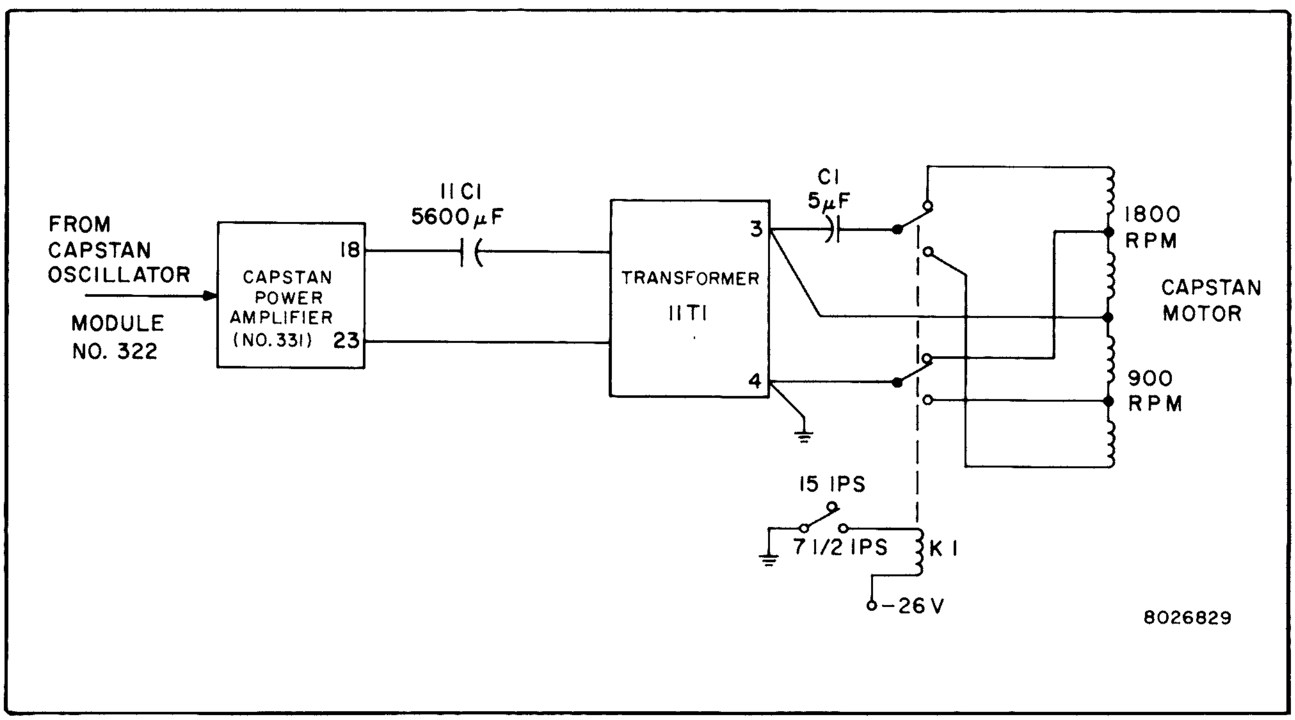


Figure 120a—Capstan Power Amplifier and Motor Circuits for Machines Equipped with Two-Speed Capstan Motor

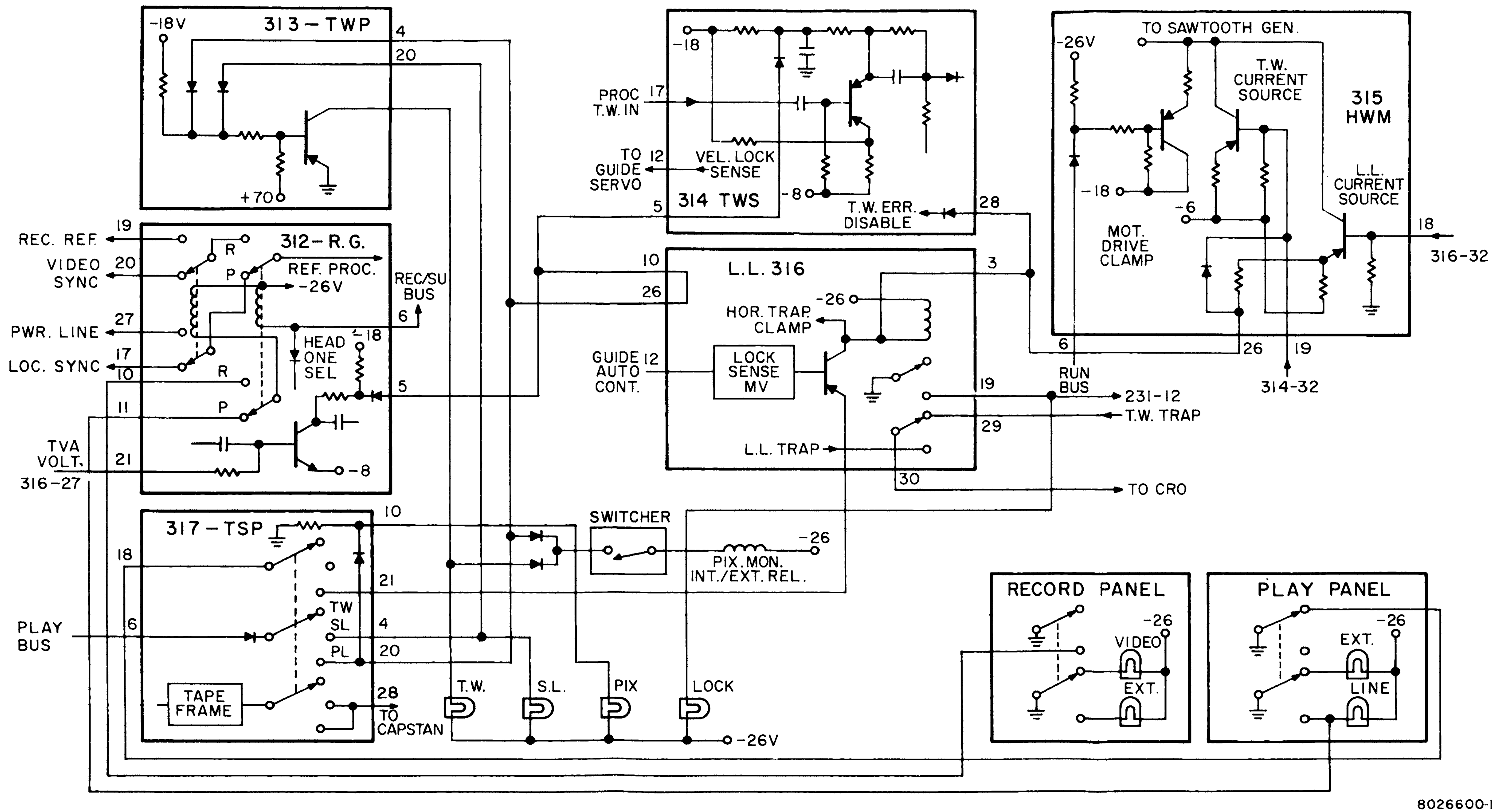


Figure 124a—Headwheel Servo Controls and Indicators Diagram

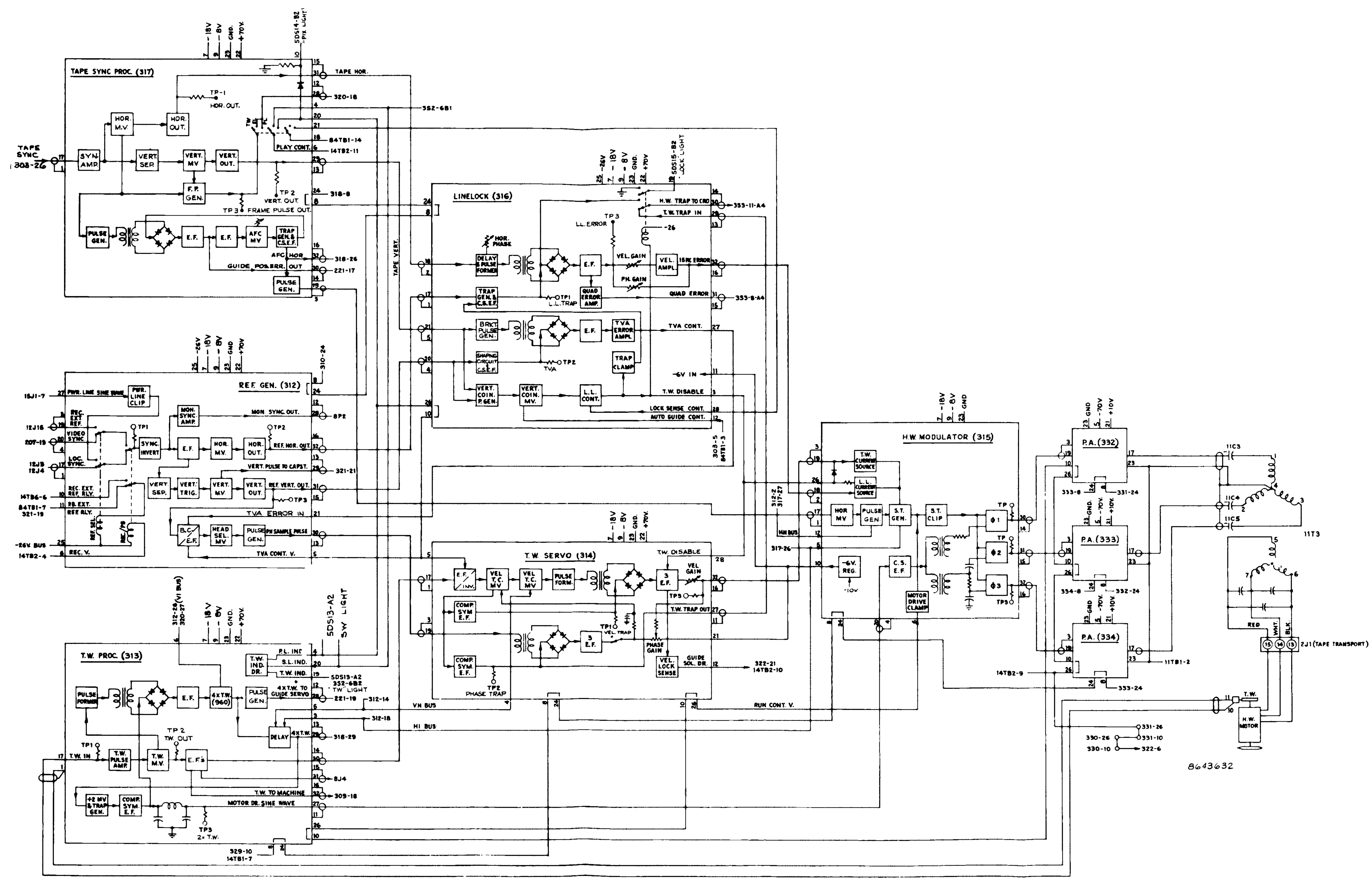


Figure 125a—Headwheel Servo Functional Diagram

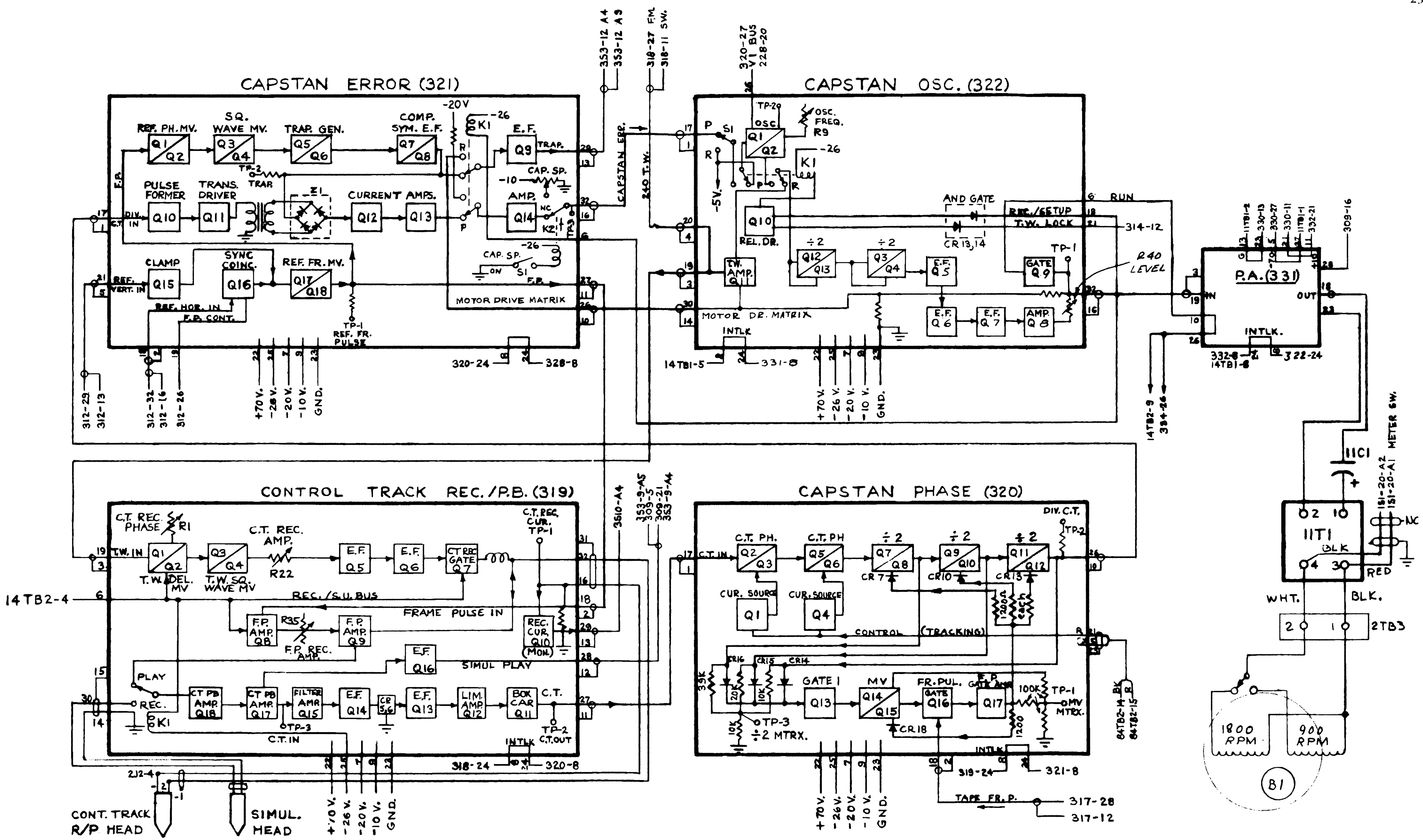


Figure 126a—Capstan Servo Functional Diagram

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